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10/573,864

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Wulf Nagel

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EXAMINER

TRINH, THANH TRUC

ART UNIT

PAPER NUMBER

1795

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/573,864	<b>Applicant(s)</b> NAGEL, WULF	
	<b>Examiner</b> THANH-TRUC TRINH	<b>Art Unit</b> 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 05 May 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>3/29/06</u>   | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 2, 4-6, 8-11 and 13-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2 depends on claim 1 and recites limitation "the working element is substantially electrically insulated" in line 2, while claim 1 recites "an electrically conductive large-surface working element" in line 3 and "the working element having a greater electron mobility than the photon absorber" in lines 6-7. It is unclear how a working element is an electrically conductive and substantially electrically insulated at the same time.

Claim 4 recites limitation "the conductors" in line 2. There is no antecedent basis for this limitation. As claim 4 depends on claim 3 and recites limitation "the conductors" in a plural form, while claim 3 claims "at least one conductor" in a singular form.

Claims 5 recites limitation "the conductors" in line 2. There is no antecedent basis for this limitation. As claim 5 depends on claim 3 and recites limitation "the conductors" in a plural form, while claim 3 claims "at least one conductor" in a singular form.

Claim 6 recites limitations "the positive conductors" and "the negative conductors" in lines 3-5. There are no antecedent bases for these limitations. In addition, the meets and bounds for the whole claim cannot be determined. For example,

there are positive conductors and negative conductors from each absorber. It is unclear whether the negative conductors and positive conductors from the same absorber are separated or from different absorbers are separated. The claim will be treated as the positive and negative conductors of one absorber are separated from the positive and negative conductors of the other absorber.

Claim 8 recites limitation "the photon absorber is substantially made of silicon, especially of anisotropic monocrystalline silicon" in lines 2-3. It is unclear to exactly what is claimed. Claim 8 recites the broad recitation "the photon absorber is substantially made of silicon" in line 2, and the claim also recites "especially of anisotropic monocrystalline silicon" which is the narrower statement of the range/limitation. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131 USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949). In addition, the phrase "especially" renders the claim

indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d). Claim 8 will be treated as in an alternative form, i.e. the photon absorber is made of silicon or anisotropic monocrystalline silicon.

Claim 9 recites limitation "two respective photon absorbers" in lines 1-2. It is unclear because claim 9 depends on claims 8 and 1 which refer to only one photon absorber.

Claim 10 recites term "mostly, especially entirely" in line 1. It is unclear is to exactly what is claimed.

Claim 11 recites limitation "the 3.-6. main group" in line 2 and "the 1.-8. subgroup" in line 3. There are no antecedent bases for these limitation. It is unclear as to what "3.-6. main group" and "1.- 8. subgroup" are referring to. Claim 11 also recites limitation "its electron configuration preferably having a d-layer occupied by at least ten electrons. It is also unclear what "its electron configuration" referring to, i.e. "the 3.-6. main group" or "the 1.-8. subgroup" or the metal. In addition, the electron configuration of d-layer can only have ten electrons maximum. A d-layer cannot have more than ten electrons. Therefore it is unclear how a electron configuration of d-layer having more than ten electrons or at least ten electrons. The claim will be treated as the metal has electron configuration of d-layer which is occupied by ten electrons.

Claim 13 recites term "(54)" in line 1. It is unclear what "(54)" represents.

Claim 14 is rejected because it is unclear what being claimed. Claim 14 depends on claim 13 and recites limitation "a plurality of photovoltaic elements are arranged in at

least one recess" which is in contrast with limitation "[a] photovoltaic device comprising a receiving element (54) with recesses in which at least one photovoltaic element of claim 1 is arranged" in lines 1-3 of claim 1.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-5 and 8-11 are rejected under 35 U.S.C. 102(b) as being anticipated by Evans Jr. et al. (US Patent 4341918).

Regarding claim 1, as seen in Figure 1, Evans Jr. et al. teaches a photovoltaic element comprising a photon absorber (or p-type base layer 12) and an electrically conductive large-surface working element (or p<sup>+</sup> field region 14) that is at least partly embedded in the photon absorber, wherein the working element is separated from the photon absorber by a phase boundary (or having a higher conductivity), and the working element having a greater electron mobility than the photon absorber by having a p<sup>+</sup> doping comparing to a p doping of the photon absorber. (See col. 4 line 17 to col. 5 line 14)

Regarding claim 2, as seen in Figure 1, Evans Jr. et al. teaches the working element (or p<sup>+</sup> field region 14) does not connected to any conductive electrode.

Therefore it is the Examiner's position that the working element (or p+ field region 14) is substantially electrically insulated.

Regarding claim 3, as seen in Figure 1, Evans Jr. et al. teaches at least one conductor (p+ base 20) is at least partly embedded in the photon absorber and has the same composition as the working element.

Regarding claim 4, as seen in Figure 1, Evans Jr. et al. teaches the working element (14) and the conductors (20 or 22) are elongate and substantially parallel to each other.

Regarding claim 5, as seen in Figure 1, Evans Jr. et al. teaches the conductors (20 or 22) are configured as a positive conductor (20) and a negative conductor (22), wherein the positive conductor (20) ends at a first front side of the photon absorber (either the side facing downward or "out of page" or "into the page" as seen in Figure 1) and the negative conductor ends at a second front side of the photon absorber (either the side "out of page", "into the page" or facing downward as seen in Figure 1).

Regarding claim 8, Evans Jr. et al. teaches the photon absorber (or p-type base 12) is made of silicon wafer (See col. 4 lines 17-38 or col. 7 lines 10-15).

Regarding claim 9, a mutually anti-parallel crystal structure can possibly occur when the absorbers are made of anisotropic monocrystalline silicon. Since the reference to Evans Jr. et al. meets the requirements of a choice in claim 8, "the absorber is made of silicon", it is also deemed anticipatory for claim 9 as claim 9 only limit to the other choice of claim 8, "the absorber is made of anisotropic monocrystalline silicon".

Regarding claims 10-11, Evans Jr. et al. also the material used for the solar cell is made of IIIA-VA or IIB-VIA (See col. 4 lines 35-37). It is the Examiner's position that material in group IIIA such as Ga, In or IIB such as Zn, Cd are metals having electron configuration of at least ten electrons in d-layer.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
  2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
3. Claims 6-7 and 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Evans Jr. et al. in view of Warner (US Patent 3994012)

Evans Jr. et al. teaches a photovoltaic element as applied to claims 1-5, 8 and 10-11.

Evans Jr. et al. does not teach two photon absorbers are in contact via an abutment surface in which the positive conductors are separated from the negative



conductors by the abutment surface; or a plurality of positive conductors are connected with each other through an omnibus and a plurality of negative conductors are connected with each other via a second omnibus conductor; or a plurality of photovoltaic elements arranged in a recess wherein the recess is in contact with at least one photon absorber.

With respect to claims 6-7, as seen in Figures 15-20 and 32-33, Warner teaches a photovoltaic element having a multi-layer structure, wherein at least two absorbers (right and left columns of multilayers of N and P) are provided in contact via an abutment surface (or the bottom surface of interconnection 45 as seen in Figures 15-20) in which the positive conductors (P+ regions next to the interconnection 45) and the negative conductors (N+ regions next to the interconnection 45) are arranged such that the positive conductors and the negative conductors are separated from each other by the abutment surface, and the plurality of positive conductors are connected with each other through a first omnibus conductor (or interconnection 45 via comb-like extension 62) and a plurality of negative conductors are connected with each other via a second omnibus conductor(or interconnection 45 via comb-like extension 60).

With respect to claims 13-16, as seen in Figures 15-20 and 27-33, Warner teaches a photovoltaic device comprising a receiving element (substrate 40 as seen in Figures 27-33) with recesses in which at least one photovoltaic element (columns of P and N layers) is arranged, wherein conductors (P+ and N+ regions) present in the photovoltaic element are each connected to omnibus conductors (or interconnection 45 as seen in Figures 15-20). Warner also teaches a plurality of photovoltaic elements

(absorbers layer of P material and conductors P+ and N+) are arranged in at least one recess, wherein the recess is in contact with at least one photovoltaic element (See Figures 27-33). Warner further teaches a connecting means (interconnection 45) for mechanically and electrically connecting at least two photovoltaic devices arranged side by side, wherein a plurality of first connecting conductors (i.e. comb-like extension 62) and a plurality of second connecting connectors (comb-like extension 60) are each connected with first current conductor (an interconnection 45 as seen in Figure 19) and second current conductor (another interconnection 45 as seen in Figure 19).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the photovoltaic element (or device) of Evans Jr. et al. by having absorbers in contact via an abutment surface, absorbers in recesses and mechanical and electrical connection as taught by Warner, because Warner teaches a photovoltaic cell including all the limitations disclosed by Warner and recited above would increase cell efficiency. (See Abstract of Warner)

4. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Evans Jr. et al.

Evans Jr. et al. teaches a photovoltaic element as applied to claims 1-5, 8 and 10-11. Evans Jr. et al. also teaches the device (or p-type crystal) operates in the range of resistivity of 0.01 ohm-cm and 30000 ohm-cm (See col. 4 lines 16-37), or the conductivity of  $(1/3) \times 10^{-4}$  to  $100 \Omega^{-1}\text{cm}^{-1}$ . Note: the conductivity is the inverse of the resistivity. Evans Jr. et al. further teaches the working element (or p+ field region 14)

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has a p+ conductivity, or a higher conductivity than the p-type crystal. Therefore it would have been obvious to one skilled in the art that the time the invention was made that the working element (or p+ field region 14) of Evans Jr. et al. has an electric conductivity higher than  $1.4 \Omega^{-1}\text{cm}^{-1}$ , or  $1.6 \Omega^{-1}\text{cm}^{-1}$  or  $2.0 \Omega^{-1}\text{cm}^{-1}$ , because Evans Jr. et al. teaches the conductivity of p-type crystal (a lesser conductivity compared to the p+) is up to  $100 \Omega^{-1}\text{cm}^{-1}$ . In addition, it would certainly have been obvious to one skilled in the art to select a portion of range, including the claimed range, from a broader range disclosed in the prior art because the prior reference finds that the entire disclosed range has a suitable utility.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THANH-TRUC TRINH whose telephone number is (571)272-6594. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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5/29/2008

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